

BEFORE THE
FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

In the Matter of)	
)	
Amendment of the Commission's Rules)	ET Docket No. 96-102
to Provide for Operation of Unlicensed NII)	RM-8648
Devices in the 5 GHz Frequency Range)	RM-8653
_____)	

PETITION FOR RECONSIDERATION OF CLARITY WIRELESS, INC.

Clarity Wireless, Inc. ("Clarity") hereby petitions for reconsideration of the Commission's Memorandum Opinion and Order adopted on June 17, 1998, in the above-captioned proceeding ("*Memorandum Opinion and Order*").¹ Specifically, Clarity seeks reconsideration of the Commission's decision to limit the directive antenna gain of fixed point-to-point wireless U-NII devices. According to the *Memorandum Opinion and Order*, antenna gains over 23 dBi are permissible only as long as transmitter output power and power spectral density are reduced by 1 dB for every 1-dB increase in antenna gain. Clarity hereby petitions to have the 23-dBi limit on antenna gain removed for point-to-point links so that unlimited directivity is permitted for point-to-point links without any reduction in transmitter output power or power spectral density.

I. BACKGROUND AND SUMMARY

The Commission has authorized the 5.725-5.825 GHz band for the operation of U-NII (Unlicensed National Information Infrastructure) devices as defined in Subpart E of Part 15 of the Commission's rules, as well as for spread-spectrum devices satisfying the requirements of 47 C.F.R. § 15.247.² The rules for the operation of U-NII devices initially were adopted to make unlicensed broadband high data rate services more rapidly available to the public.³ The Commission has

¹ See 63 Fed. Reg. 40,831 (July 31, 1998).

² This band is also shared with amateur radio services and government radiolocation services.

³ See *Report and Order*, 12 FCC Rcd 1576, 1589, ¶ 27 (1997) ("Initial Report and Order"), at ¶ 27.

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expressed the hope that these services will help meet the demands of educational, medical, business, industrial, and consumer users for broadband multimedia communications, as well as foster the development of new industries.⁴

In the *Initial Report & Order*, the Commission set radiated power limits for both U-NII devices and for spread-spectrum devices. For U-NII devices operating in the 5.725-5.825 GHz band, peak transmit power could not exceed 1 W and peak power spectral density could not exceed 50 mW/MHz. Furthermore, if transmitting antennas of direction gain greater than 6 dBi were to be used, both the peak transmit power and the peak power spectral density had to be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

After considering a petition for reconsideration filed by Apple Computer, Inc.,⁵ opposing arguments submitted by AT&T and the American Radio Relay League, and comments submitted by the NTIA, the Commission modified the U-NII directivity limit for the 5.725-5.825 GHz band. In the *Memorandum Opinion and Order*, the Commission increased the permitted antenna directivity for point-to-point links to 23 dBi with no reduction of the 1 W peak transmit power and peak spectral density of 50 mW/MHz.⁶ For a directivity level above 23 dBi, the Commission now requires a 1-dB reduction in maximum transmit power and power spectral density for every dB of directivity above 23 dBi.

Although the Commission's change in directivity limits in the 5.725 GHz-5.825 GHz band was an important step in the right direction, it nevertheless continues to leave the full potential for U-NII services unrealized. In particular, the Commission originally envisioned successful operation of community networks with a typical range of several kilometers and even longer-range communication in low-interference environments.⁷ That vision is not readily attainable under the directivity limit promulgated in the *Memorandum Opinion and Order*, which significantly restricts

⁴ *Id.*

⁵ Clarity also filed a Petition for Rulemaking requesting that the directivity limits for the U-NII band be removed. The Commission dismissed Clarity's Petition, indicating that it was moot in view of the Apple petition, which was substantively similar. *Memorandum Opinion and Order* at ¶ 62.

⁶ *Id.* at ¶ 26.

⁷ *Initial Report and Order*, 12 FCC Rcd at 1596, ¶ 46.

the potential for long-range high data rate communication that require directivities greater than 23 dBi. Clarity believes that users in rural areas will be particularly hard hit by this limitation.

The Commission's reasoning for continuing to limit antenna directivity seems to rely on the potential for interference of government radar transmitters with U-NII receivers. This reasoning is puzzling, however, since U-NII *transmitter* directivity cannot possibly affect the potential for radar interference to U-NII receivers. Furthermore, the current rules remain biased in favor of Section 15.247 spread-spectrum devices, which are allowed *unlimited directivity* for point-to-point links.⁸ The result is a more favorable environment for spread-spectrum systems than for U-NII systems, even though U-NII systems are capable of providing wireless multimedia services to the public that spread-spectrum systems cannot.

In granting the use of unlimited gain for point-to-point links using Section 15.247 spread-spectrum devices, the Commission has already deemed the use of highly directive antennas to be highly advantageous and in the public interest for a number of reasons. Clarity agrees with the Commission that fixed transmitters tend to interfere with one another less when they employ directive antennas.⁹ Clarity further agrees that the potential for increased interference to mobile receivers that move into a beam of a fixed station is low in this band because of the low preponderance of mobile users.¹⁰ *These reasons apply just as strongly to U-NII systems as to spread-spectrum systems.*

Because U-NII systems serve important public purposes, the restriction on their use of directional antennas should be completely relaxed in the same manner that this restriction has been relaxed for spread-spectrum devices. Removing the directivity restriction as Clarity requests will further all of the goals envisioned when the 5.725-5.825 GHz band was made available for U-NII devices in the first instance. By contrast, preserving the rule adopted in the *Memorandum Opinion and Order* will lock in a disparity between U-NII and spread-spectrum devices that has no rational logical or public policy basis. Indeed, the existing directivity limit will make U-NII devices unduly

⁸ Amendment of Parts 2 and 15 of the Commission's Rules Regarding Spread Spectrum Transmitters, *Report and Order*, 12 FCC 7488 (1997) ("Spread-Spectrum Order").

⁹ *Id.* at 7494-95, ¶ 11.

¹⁰ *Id.*

susceptible to interference from spread-spectrum devices -- a result that is certainly not consistent with the goal of this proceeding or, more broadly, the U-NII spectrum allocation.

Finally, removing the restrictions on the directivity of point-to-point U-NII radiators will not change the potential for harmful interference to the amateur radio and radiolocation services that share the 5.725-5.825 GHz band. Any potential for interference from directional U-NII radiators will be identical in magnitude to the potential for interference already presented by Part 15 spread-spectrum devices, which are permitted unlimited antenna directivity gain.

II. IT IS INAPPROPRIATE TO LIMIT U-NII TRANSMITTER DIRECTIVITY TO AVOID POTENTIAL RADAR INTERFERENCE TO U-NII RECEIVERS

In raising the directivity gain limit to 23 dBi -- rather than removing the limit entirely -- for point-to-point U-NII devices in the 5.725-5.825 GHz band, the Commission deferred to the NTIA's stated concern that high-power Government radar systems could interfere with highly directional U-NII *receiver* devices.¹¹

This line of reasoning, however, completely misses the point that the rules regulate *transmitter* antenna directivity rather than *receiver* antenna directivity. Operators of all Part 15 systems must accept whatever harmful interference is generated by licensed services (including the government radar installations that operate in the 5.725-5.825 GHz band). It simply is not appropriate to limit transmitter directivity for such reasons, and indeed, it is difficult to see why radar interference to U-NII receivers is relevant at all.

Neither is the Commission's directivity limit supported by the asserted difficulty of predicting the extent of the proliferation of U-NII devices that may operate in the 5.725-5.825 GHz band.¹² No matter how many U-NII devices proliferate, it will continue to be the operators who will be responsible for the consequences of interference to U-NII receivers. Indeed, the kind of directivity restriction imposed by the Commission may serve to artificially and needlessly limit U-NII device proliferation. If radar interference is in fact to be a problem for highly directive U-NII

¹¹ *Memorandum Opinion and Order* at ¶ 25.

¹² *Id.* at ¶ 25.

receivers, the operation of the wireless equipment marketplace will be sufficient to limit the use of such receivers to applications where they can provide the necessary quality of service.¹³

III. THE RULES ADOPTED BY THE COMMISSION MAKE U-NII DEVICES UNDULY SUSCEPTIBLE TO INTERFERENCE FROM PART 15 SPREAD-SPECTRUM DEVICES.

U-NII devices will be able to support significantly higher data rates than Part 15 spread-spectrum devices. Part 15 spread-spectrum devices cannot provide the multimedia services envisioned for U-NII devices. Yet, the disparity in permitted antenna directivity between the two types of devices will heavily favor usage of the band by Part 15 spread-spectrum devices rather than U-NII devices.

Consider the first situation in the attached Figure 1. A U-NII transmitter and a U-NII receiver communicate with each other over a point-to-point link. The U-NII receiver is, however, also within the beam of an interfering Part 15 spread-spectrum transmitter having a directional antenna. Assume that both the U-NII transmitter and the spread-spectrum transmitter have 30-dBi antennas. If the rules treated U-NII devices and spread-spectrum devices equally, the spread-spectrum interferer may be located as close as distance x and not disrupt communications between the two U-NII devices. However, under the Commission's antenna directivity rules, the U-NII transmitter must reduce its output power by 7 dB relative to the spread-spectrum interferer. Now, the spread-spectrum interferer must be located at a distance of **2.24x** to avoid disruption to the U-NII link.

By contrast, the current directivity limits make Part 15 spread-spectrum receivers relatively immune to interference from directional U-NII transmitters. Consider the second situation in the attached Figure 1 where a spread-spectrum transmitter and a spread-spectrum receiver are communicating over a point-to-point link. The spread-spectrum receiver is also within the

¹³ If the NTIA's concern is actually that the proliferation of U-NII devices might threaten the government radars that use the band, then Clarity would direct the Commission's attention to a study conducted by the European Radiocommunications Committee (ERC), ERC Report 15, *Compatibility Study Between Radar and RLANs Operating at Frequencies Around 5.5 GHz*, which concludes that "taking into account the relative power levels of radars and RLANs, radar systems will, in effect, create their own exclusion zones." European Radiocommunications Committee (ERC), *Compatibility Study Between Radar and RLANs Operating at Frequencies Around 5.5 GHz*, ERC Report 15, <http://www.ero.dk/doc98/Official/Pdf/REP015.PDF>, Madrid, October 1992, p. 5. Thus, there is little basis for such an interference concern.

transmission beam of a U-NII transmitter having a directive antenna. Again, assume that both transmitters have 30-dBi antennas. If both transmitters are permitted to transmit at the same power, the U-NII transmitter may be at a distance x or greater without disrupting the link between the spread-spectrum devices. However, under the Commission's directivity rules, the U-NII transmitter must reduce its power by 7 dB relative to the spread-spectrum transmitter. The U-NII transmitter would not interfere unless it was at a distance **0.45x** or closer to the spread-spectrum receiver.

The effect of these disparities will be that Part 15 spread-spectrum systems will continue to operate effectively, while U-NII systems will suffer more from interference in the areas where they share spectrum. In short, the proliferation of the spread-spectrum systems can continue, while the adoption of U-NII systems will be hindered by the more severe interference environment that U-NII systems will experience.

This departure from technological neutrality in the Commission's rules is unwarranted, especially when only the U-NII systems can provide the broadband services anticipated by the Commission. The unfortunate consequence of this disparate treatment being enshrined into Commission rules will be spectrum usage far different than what was originally intended by the Commission in providing spectrum for U-NII technologies.

IV. U-NII SERVICES WILL NOT REACH THEIR FULL POTENTIAL UNDER THE ADOPTED DIRECTIVITY LIMITS

Point-to-point U-NII services will operate over shorter ranges under the directivity limitations adopted in the *Memorandum Opinion and Order* than would otherwise be possible. For free-space paths, each 6-dB increase in antenna gain represents a doubling in available range. For cluttered paths, an increase of 12 dB or more in antenna gain is needed to double the available range. Without use of directivity levels above 23 dBi, U-NII services will not reach their full potential in servicing educational, medical, industrial, business, and consumer users.

Clarity believes that users in remote rural areas, where low population density mandates longer transmission distances, will be particularly harshly affected. To see how this is so, consider a best-case line-of-sight point-to-point link between rural schools to provide multimedia distance learning, thereby allowing expensive specialized courses to be offered to many more students. Using one representative implementation of Clarity's proprietary technology that would be

used in connection with a U-NII device, it would be possible to provide a T-3 link at a distance of 7 miles where peak transmitter power is limited to 1 Watt and antenna directivity is limited to 23 dBi.¹⁴ If directivity limits were removed for point-to-point links as requested by Clarity, it would be relatively easy to furnish a 28-dBi antenna, *e.g.*, a parabolic dish with a two-foot diameter, without any reduction in transmitter power. Now, schools as far apart as 21 *miles* could be serviced. Greater distances could be covered with correspondingly higher directivity. For many applications, this difference in range will be the difference between availability and non-availability of revolutionary wireless services.

V. ANY INTERFERENCE POTENTIAL WOULD BE SIMILAR TO THAT ALREADY PERMITTED TO PART-15 SPREAD-SPECTRUM DEVICES.

Removing the restrictions on the directivity of point-to-point U-NII radiators will not change the potential for harmful interference to the amateur radio and radiolocation services that share the 5.725-5.825 GHz band.

In its *Spread-Spectrum Order*, the Commission removed directivity limits on Part-15 spread-spectrum devices in the 5.725-5.825 GHz band. In the *Memorandum and Order*, the Commission correctly noted that U-NII point-to-point operations “will not pose any higher interference potential than that posed by the unlicensed spread-spectrum devices already permitted in this band.”¹⁵

Any potential for interference from directional U-NII radiators will be identical in magnitude to the potential for interference already presented by Part 15 spread-spectrum devices, which are permitted unlimited antenna directivity gain. In this circumstance, the Commission rules should not favor the development of any particular technology. The directivity limits for spread-spectrum devices have been removed entirely. If the interference potentials of spread-spectrum and U-NII devices are indeed equivalent, as the Commission asserts, then directivity limits for point-to-point U-NII devices should also be eliminated. To do otherwise unfairly discriminates in favor of

¹⁴ A fade margin of 20 dB is provided in this example for 99% link reliability (99.9% if spatial antenna diversity is used).

¹⁵ *Memorandum Opinion and Order* at ¶ 25.

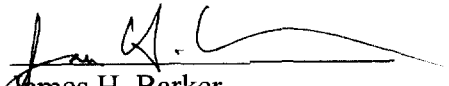
spread-spectrum over technologies which may offer benefits that simply are unavailable with spread-spectrum systems.

VI. CONCLUSION

For the reasons set forth above, the Commission should remove the limits on antenna directivity for point-to-point U-NII links in the 5.725-5.825 GHz band. Clarity respectfully requests the Commission to reconsider and modify its U-NII directivity restrictions consistent with the views expressed herein.

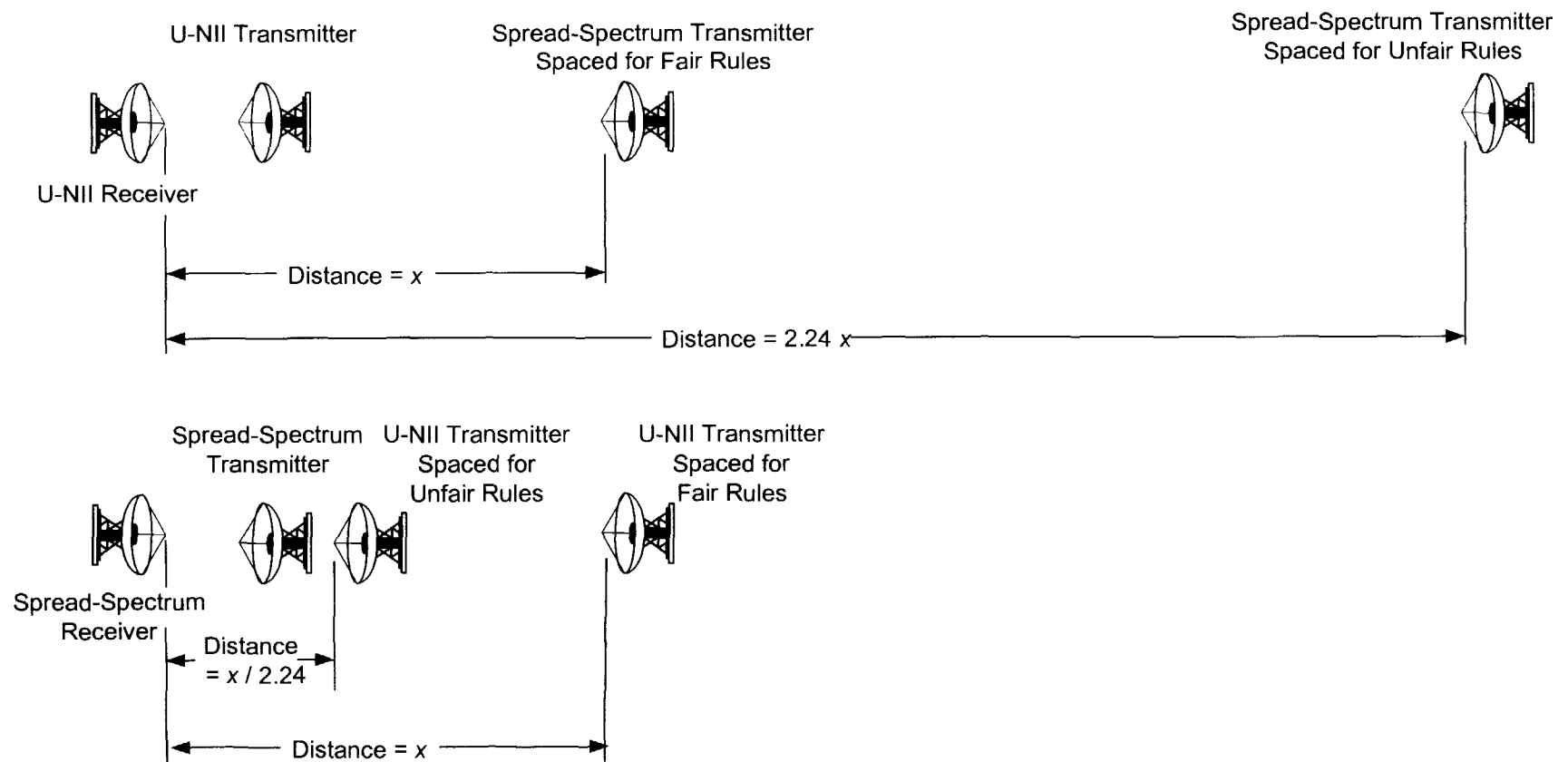
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Figure 1. Example of Interference Performance Inequity



DECLARATION OF GREG DESBRISAY

I, Greg DesBrisay, hereby declare as follows:

1. I am a Senior Engineer at Clarity Wireless, Inc. I am an engineer by training and am familiar with the interference and technical issues referenced in the foregoing petition.
2. I have reviewed the foregoing filing from a technical perspective, and the information found therein is true and accurate to the best of my knowledge, information and belief.


Greg DesBrisay
Senior Engineer
Clarity Wireless, Inc.

August 31, 1998